SUPERCHARGING DEVICE FOR ENGINE

FIELD OF THE INVENTION

[0001] The present invention relates to a supercharging device for an engine, which enables to protect an electric supercharger from exhaust heat while preventing deposition of condensed water within an intercooler, and which is mountable around the engine in a compact manner

BACKGROUND ART

[0002] Development on an engine with an electric supercharger, which includes an engine, a turbocharger which supercharges intake air by using exhaust energy of the engine, and an electric supercharger which compensates for the supercharging performance of the turbocharger when the engine is in a low speed range, has progressed. Japanese Unexamined Patent Publication No. 2006-220124 (hereinafter, referred to as Patent Literature) discloses an example of the aforementioned configuration.

[0003] An engine with an electric supercharger illustrated in FIG. **5** of Patent Literature includes an engine; an intake passage which introduces intake air into the engine; an exhaust passage which discharges exhaust air from the engine; a turbocharger including a turbine disposed on the exhaust passage, and a compressor disposed on the intake passage; an intercooler disposed on the downstream side of the compressor on the intake passage; a bypass passage which communicates between the intercooler and the compressor on the intake passage; and an electric supercharger disposed on the bypass passage.

[0004] When intake air whose temperature is increased by compression by a compressor is cooled by an intercooler, water condensation may occur within the intercooler. Although the positional relationship between an intercooler and an intake port of an engine in the up-down direction is not clear from the description of Patent Literature, when the intercooler is located on the lower side than the intake port, the following problem may occur. Specifically, when a state that the engine speed is low (e.g. an idling state) is continued for a long time, water droplets by water condensation may not be sucked into the engine, and condensed water may deposit within the intercooler. If the engine speed is rapidly increased in this state, a large amount of condensed water may be instantaneously sucked into the engine together with the air, and liquid compression may occur within the engine.

[0005] In order to solve the aforementioned drawback, for instance, there is an idea of disposing an intercooler on the upper side than a cylinder head of an engine. When the intercooler is disposed as described above, water droplets generated by water condensation are sucked into an engine immediately after generation of condensed water. This may make it difficult to cause deposition of condensed water within an intercooler, and may prevent liquid compression. In the aforementioned configuration, however, the position of the upper end of the intercooler is set high. This may increase the height of a hood.

[0006] Further, although the position of an electric supercharger with respect to an engine is not clear from the description of Patent Literature, when the electric supercharger is disposed on the exhaust side of the engine, the electric supercharger may cause an operation failure by exhaust heat because the heat resistance of a motor in the electric supercharger is low.

[0007] Further, in recent years, in a family vehicle, there is a demand for downsizing i.e. reducing the size and the weight of a vehicle while securing a high output with a compact engine for improving the fuel economy. Therefore, there is a demand for miniaturizing an engine with an electric supercharger.

SUMMARY OF THE INVENTION

[0008] In view of the above, an object of the present invention is to provide a supercharging device for an engine, which enables to protect an electric supercharger from exhaust heat while preventing deposition of condensed water within an intercooler, and which is mountable around the engine in a compact manner.

[0009] An aspect of the present invention is directed to a supercharging device for an engine including a cylinder head with intake ports. The supercharging device includes an electric supercharger which supercharges intake air to the engine; an intercooler which cools intake air discharged from the electric supercharger; and an intake manifold which is disposed substantially horizontally, and is configured to communicate between a downstream end of the intercooler in an intake air flow direction, and the intake ports. The downstream end of the intercooler is located on a lower end of the intercooler, and the downstream end of the intercooler is disposed substantially at a same height as an upstream end of the intake ports. The electric supercharger is disposed below the intercooler along a surface of the engine on an intake side where the intake ports are opened.

[0010] These and other objects, features and advantages of the present invention will become more apparent upon reading the following detailed description along with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011] FIG. **1** is a schematic diagram illustrating an overall structure of an engine provided with a supercharging device according to an embodiment of the present invention;

[0012] FIG. **2** is a perspective view illustrating the engine;

[0013] FIG. **3** is a side view of the engine when viewed from the intake side;

[0014] FIG. **4** is a plan view illustrating the engine;

[0015] FIG. **5** is a side view of an intake manifold and an intercooler when viewed in the cylinder array direction;

[0016] FIG. **6** is a perspective view illustrating the intake manifold and a surge tank of the intercooler;

[0017] FIG. **7** is a plan view illustrating the intake manifold and the surge tank of the intercooler;

[0018] FIG. **8** is a side view illustrating the intake manifold and the surge tank of the intercooler when viewed from a direction orthogonal to the cylinder array direction;

[0019] FIG. **9** is a side view of the intake manifold when viewed from the engine side; and

[0020] FIG. **10** is a perspective view illustrating an intercooler core.

DESCRIPTION OF EMBODIMENTS

[0021] In the following, a preferred embodiment of the present invention is described in detail referring to the accompanying drawings.